Pit and Quarry

SAND · GRAVEL · STONE

HANDLING ▪ CRUSHING ▪ SCREENING ▪ WASHING

GEOLOGICAL SURV

AUG 10 1918

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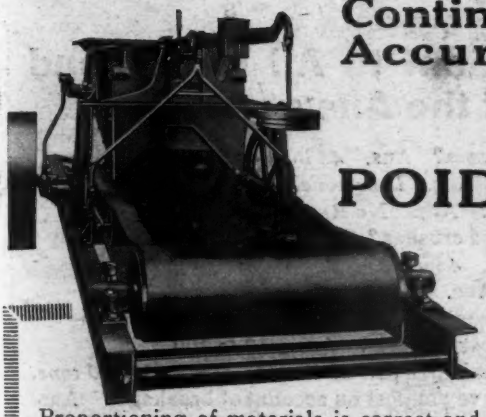

Continuous, Automatic Accurate Weighing

is accomplished with

THE POIDOMETER

Handles quantities from 1½ to 21,000 pounds per minute of an unlimited number of materials. Indispensable to lime and cement plants.

Proportioning of materials is correct and automatic. The weight on the middle roller actuates the scale beam and controls the gate opening, so that the exact amount of material is liberated to maintain a uniform weight on the roller. Easy to install. Feeds from bin, elevator or conveyor. Cannot clog in hopper. Bearings dustproof. Liquid measure attachment gives a mixture of any desired consistency.

The POIDOMETER is explained in detail in Bulletin No. 5. Send for a copy.

The Schaffer Engineering and Equipment Co. Tiffin, Ohio

AUGUST, 1918

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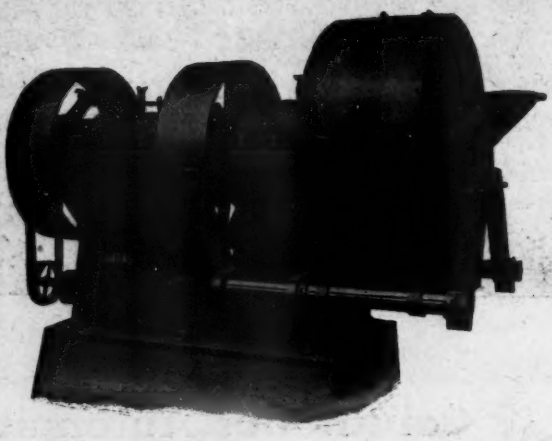
SYMONS DISC CRUSHER



READY FOR IMMEDIATE DELIVERY

Questionnaire Sent to All Users, and One of the Answers

Q. Size crusher this report covers? Ans. *48 inch.*
Q. Kind of material crushed? Ans. *Limestone.*
Q. What moisture in material? Ans. *No Record.*
Q. How long have you operated crusher? Ans. *3 years.*
Q. What is size of feed? Ans. *4 inches.*
Q. What is size of product? Ans. *1½ inch.*
Q. What horsepower does it require? Ans. *65.*
Q. How many tons per hour does it crush? Ans. *80 to 100.*
Q. How many tons do you crush per pair of discs? Ans. *750,000 tons.*
Q. What percentage of time have you lost on account of breakage? Ans. *None.*
Q. Give your opinion of this crusher as compared to rolls. Ans. *Would not use rolls.*
Q. Give your opinion of this crusher as compared to a jaw crusher. Ans. *Superior to Jaw crusher.*
Q. Give your opinion of this crusher as compared to a Gyratory crusher. Ans. *Superior to Gyratory crusher.*

Signed *Name on Request.*

Many more like this, also reports of the success of the crusher on different kinds of material.

Also built in sizes 18 in., 24 in. and 36 in.

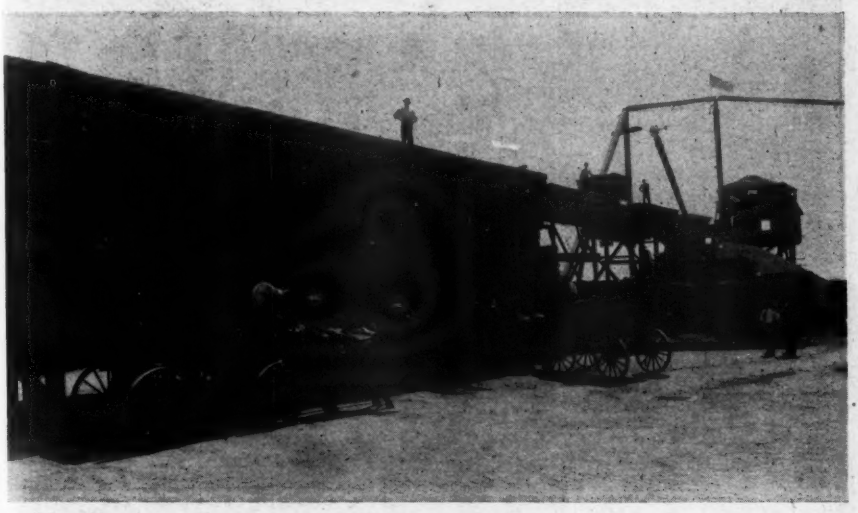
Manufactured and Sold Only by

Chalmers & Williams

CHICAGO HEIGHTS, ILL.

Pit and Quarry

Vol. 2 Chicago, Ill., August, 1918 No. 9



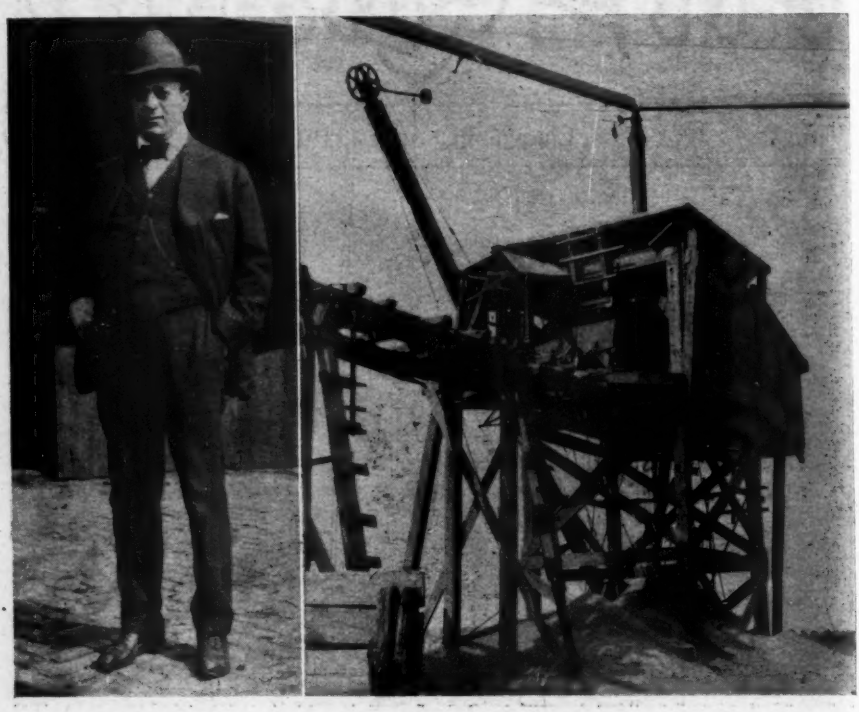
STORAGE BINS OF EVANSVILLE SAND & GRAVEL CO., SHOWING SINGLE-CAR SYSTEM OF HANDLING MATERIAL.

Single-Track Trestle Supplies Bins and Storage Yard

Revolving Crane and Two-Way Dump Car Handle Output of Dredged and Screened Material.

WITH THE OUTPUT of its three plants — 2,500 tons a day, fully contracted for the Evansville Sand & Gravel Co. is fortunately situated because of its ability to make river shipments. These plants are located at Evansville and Mt. Vernon, Ind., and Henderson, Ky. The following description applies to the first, but they are all very much alike as to operating methods.

The company has been operating since 1915. It has three suction dredges on the Ohio river taking out material on a royalty basis. Each boat can go down 40 feet, if necessary, with its 8-inch suction pipe. The pumps for these were manufactured by Holtz & Co., Evansville. Flat screens with oblong perforations—⅛ by 1 inch for the sand and ⅜ by 1¼ inch for the gravel—and in 4-foot sections, discharge into a box hopper which in turn delivers the material to the barges — sand on one side and gravel on the other. The screens



WILLIAM EICHEL, PRESIDENT—A CLOSE-UP VIEW OF THE TRESTLE, TWO-WAY DUMP CAR AND DERRICK ON THE RIVER BANK.

were furnished by Johnson & Chapman, Chicago.

There are eleven barges, which are towed to the various plants by the steamer "Greenriver," which is also owned by the company. Another steamboat, the "Eichel" was sold recently. On the dredge boats are living quarters for the men. Each boat uses a working force of twenty.

CAR ON TRESTLE HANDLES ALL MATERIAL

On the river bank, and at the edge of the water, is a revolving crane, mounted on concrete foundations, having a 70-foot boom carrying a 1½-yard Hayward clamshell bucket. By this equipment this material is taken from the barges and deposited into a wooden, inverted-pyramid-shaped hopper hold 20 cubic yards. The hopper straddles a track on a trestle. About half the length of the track extends over storage piles while the remaining section is above six 100-yards capacity bins with spouts underneath for loading wagons. Railroad cars and motor trucks are loaded under a part of the section covering the storage piles.

Traveling on this trestle is a two-way dump car loaded by gravity from the above-mentioned hopper. It is moved by a cable, trips itself at the desired point and returns. This car was manufactured by the Youngstown Car Mfg. Co., Youngstown, Ohio, and easily handles the 1,000-yards' daily average.

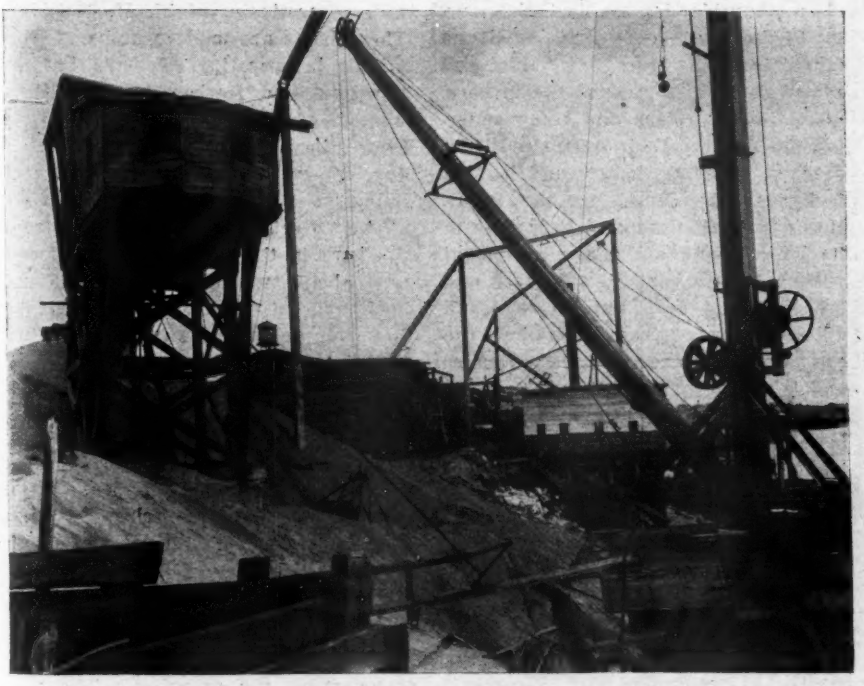
The company obtains its coal from the Dixie coal mine at Greenriver,

Ky. Wm. Eichel, president of the sand and gravel company, is also president of the Dixie coal concern and the Stratman Hoisting Co. at Henderson, Ky. The Evansville Sand & Gravel Co. also operates a $40,000 dipper dredge doing work exclusively for the United States government. The company is furnishing all of the sand and gravel for Lock and Dam 48 which the government is building below Evansville at a cost of $3,000,000. Deliveries can be made to all roads entering Evansville by means of the Belt line which reaches the plant. Shipments are made to river points with barges.

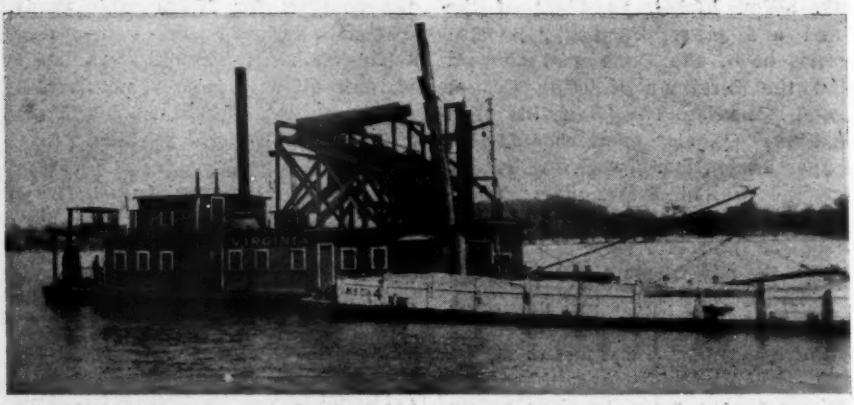
Davis county and Owensboro, Ky., have let contracts for $600,000 for gravel road improvements and $160,000 has just been let. The company furnished about two-thirds of the gravel on these roads and now has the contract for 27,000 cubic yards. The state highway department of Kentucky has adopted gravel as the material for all road improvements. Illinois counties adjacent to the Evansville section have adopted the gravel method of road repairs and Posey county, Ind., has substituted gravel for all road improvements and have built all roads of gravel. Vandervoort county, Ind., in which Evansville is located, is also making all repairs with gravel.

Architects Discuss Building Conditions.

FUTURE CONDITIONS in the building industry was the chief subject for consideration at a conference of the American Institute of Architects held June 14 in the Engineering Societies Building, New York, N. Y.



Revolving Derrick (at Right) Unloads Barges and Delivers to Car on the Trestle (at Left). Occasionally the Ground Adjoining the Trestle is Used for Storage.



Halliday Dredge Is Outgrowth of Crude Structure

Highly Efficient Boat "Virginia" Completely Equipped for Taking Care of Men and Materials.

ICE IN THE OHIO RIVER did immeasurable damage last February to the equipment taking sand and gravel from the river. Few sand and gravel companies escaped the menace, many losing barges and some suffering the loss of their entire outfit of dredges, steamers, barges and loading facilities. At Cairo, Ill., the H. H. Halliday Sand Company had some of its barges sunk and other equipment pushed up the bank of the river and left high and dry. Several thousand dollars' damage was done, but the company has made complete repairs and is operating at full capacity of 20 cars a day at the present time. H. H. Halliday, head of the concern, is a pioneer sand and gravel operator and just now is working many hours overtime daily due to the absence of his nephew-partner, who is an army officer at the front in France.

Modern River Equipment

The company's principal equipment consists of the dredge boat "Virginia," and the barge-unloading boat "Herbert," named after the daughter and son, respectively, of H. H. Halliday. These boats are modern and up-to-the-minute in operating efficiency, but the "Virginia" and "Herbert" of earlier days were box-like structures that add an interesting note to the history of the development of the sand and gravel industry.

The "Virginia" takes the sand from the bars in the river, being stationed now about two miles above the unloading point. It is 100 feet long, 22 feet wide and 28 feet high, carrying a 10-inch suction pipe attached to a Morris pump, and a screening arrangement designed and installed by the Raymond W. Dull Company. The material is pumped vertically into a receiving chute, which reduces the pressure from the pipe line, and is passed to a de-watering grizzly, feeding direct into the screens.

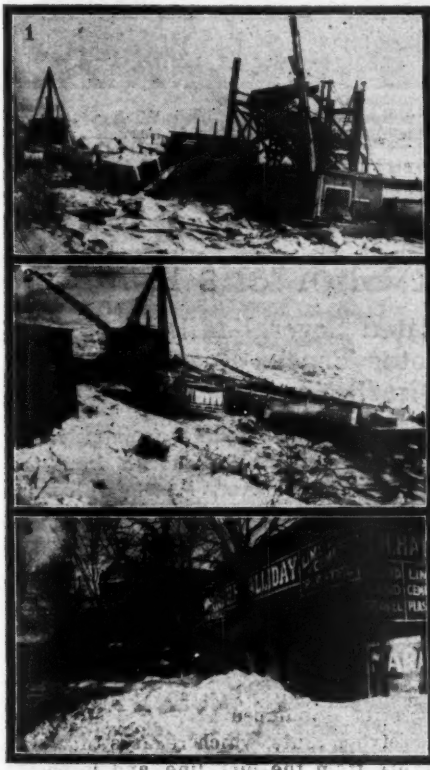
The first screen takes out one grade and passes the oversize to two other screens. Three sizes can be made by transferring the oversizes. The material is chuted into scows alongside

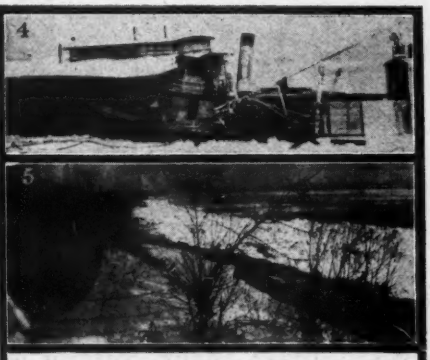
the boat, which are pulled to the unloading point by the steamer "Thesus," one barge at a time, so that while a barge is being unloaded another is being filled. Four men are employed on the "Virginia." There are four barges, each holding eight carloads.

Cars Loaded on Cradle in River

At the unloading point is the houseboat "Herbert" equipped with a derrick (Contractors' Supply Company make) and a 1½-yard Hayward bucket which take the material from the barges and load the gondola cars that come down an incline to the waters' edge and stand upon a cradle holding 20 railroad cars. Six men are employed on the "Herbert," and, as in the case of the dredge boat, living quarters are provided.

The switch extends from the Illinois Central Railroad and is located at Twenty-sixth street. At Thirty-fourth street and the river the Big Four has a similar arrangement. Here bottom-





An Unusual State of Affairs.

UNTOLD DAMAGE was done to much of the equipment of sand and gravel concerns on the Ohio River by the ice last winter. Although the destruction to the H. H. Halliday Sand Company's boats and barges at Cairo, Illinois, amounting to thousands of dollars, the company gamely went to work on repairs and is now operating full time. The pictures here tell the story.

1. Dredge boat "Virginia" pushed high up on the bank by the powerful ice floes. 2. Unloading boat "Herbert" and barges. The barge in the foreground was later sunk by the ice. The other was badly bent. Note the little houseboat alongside the barge—ice gorges may wreck many thousands of tons of equipment and endanger life, but could not interfere with the regular wash day of the old lady whose home is here. 3. Cairoites never before saw such a street scene—snow piled five feet high. 4. The Halliday company's tug boat "Thesus." Only the second story of the big wharfboat alongside is shown, for the reason that the first story rests upon the bottom of the river. 5. The deadly shore ice, frozen solidly to the bottom of the river. Concrete levee at the left. This was the first time in history that the Ohio river was frozen from bank to bank, enabling people to cross to the Kentucky side.

Houseboat "Herbert" of the H. H. Halliday Sand Co. Is Equipped With a Derrick Which Transfers Material From Barges to Railroad Cars.

dump cars can be unloaded into the Halliday company's storage yard. The city yard is at Eighth and Ohio streets and supplies wagons and motor trucks.

Distributing Plant Shortens Hauls

Concrete Storage Tanks, Located Several Miles from the Main Plant, Supply Motor Trucks Reaching in Four Directions

THE OHIO RIVER SAND CO., of Louisville, Ky., saves waste and eliminates long and expensive hauls through modern methods of delivery and general systematizing of its business. This concern dredges river sand on the Ohio, owning an island a few miles above Louisville. This sand is brought to the riverside plant in barges, transferred by machinery to hoppers and to the yard, and a considerable portion of its business is handled direct from the riverside plant.

However, Louisville has spread out over a considerable area, the city for the most part being flat and level, this resulting in fairly easy hauls. However, the company some two or three years ago erected a large substation or distributing plant in the West End, a good four or five miles from its riverside plant, but far enough from the city limits on every side to warrant a big distribution north, south, east and west from the plant, without cutting in on the territory of the main location.

Two large concrete storage tanks, each with a capacity of 300 yards, were erected. These tanks are equipped with electrical machinery which make short work of loading out, or receiving material. Sand is loaded into gondolas at the riverside plant, switched to the West end and run in on a switch over a pit, from which it is lifted by electrically operated screw conveying machinery and elevated to the tanks, or hoppers.

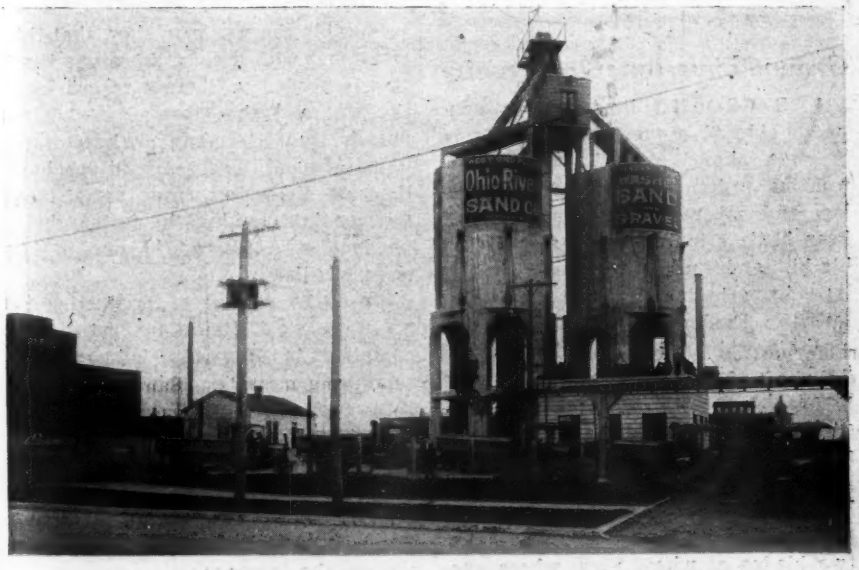
At the front entrance to the station

is a circular, paved drive, which allows the trucks to enter under the spouts which deliver sand or gravel by gravity directly into the beds of trucks or wagons. At the far side of the storage plant is found a traction company switch where traction cars from the railway company may be loaded directly from the hoppers for use on local or interurban construction.

This company was the first sand concern in the city to start using large trucks for delivering sand and gravel. A large Garford truck was first installed, and proved such a big money saver that the company later installed six Pierce Arrow trucks, and has since purchased additional trucks. These trucks have a capacity of 4½ yards of sand, or 3½ yards of gravel, whereas the old two-horse or two-mule wagons could only handle two yards of sand. The first seven trucks installed took the place of twenty horse-drawn wagons, five wagons being kept for handling deliveries in bad places where trucks can not be used to advantage.

The first truck has now been in service for almost five years, and while gasoline and tires are costly, feed is also high priced in this day, and with the greater capacity of the trucks the company has eliminated a large number of drivers, many of whom cost just about the same as truck drivers. In operating the former big stables feed had to be purchased for fifty animals to handle the twenty-five carts, and for at least ten to fifteen relief animals to be used while stock was being rested, shod or laid up by illness. Each team had to have a driver, while a large stable force was also required.

In bad weather when building operations come to a close and there is no demand for sand or gravel, the company has no difficulty whatever in keeping all of its trucks operating at full time hauling coal. Of course, wagons could be used in the same way, but it is hard on stock and many concerns preferred laying their stock up in bad weather for a rest, rather than haul coal.



Concrete Storage Tanks of the Ohio River Sand Co., Louisville, Ky.

EDITORIAL

Pit and Quarry

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Ground Limestone Opportunity

AS GROUND limestone is considered a "fertilizer," there is a chance for the quarryman working on limestone whose road, ballast and concrete stone business has been badly crippled by the war to "do his bit" and enter a "necessary industry" by grinding limestone for the farmer. Evidently with the demand of the world for large yields of farm products, every assistance will be given the farmer towards producing such. The idea of grinding limestone should, therefore, just now be an attractive one to those quarrymen who have the necessary raw material. In these days the man who can make two blades of wheat grow where one grew before or assist in doing this is certainly a patriot.

As all readers of this journal doubtless know, our inability to obtain potash, one of the most valuable ingredients of fertilizers, due to the fact that the world's supply of this is held by the Germans, has seriously interfered with our efforts to obtain maximum crops from our farms. One of the recognized remedies for lack of potash is now acknowledged to be a liberal application of ground limestone.

All soils contain some potash, but this is tightly locked up in combination with other elements. If lime or limestone is added to the soil, this helps to liberate the potash and make it available for plant food, so that one of the ways to make up for a lack of German potash is by a good application of American ground limestone to the farm.

Possibly the war may show that this treatment with lime or limestone is all that is needed to liberate potash from the soil and that instead of buying potash from Germany as heretofore, it may be only necessary to purchase lime or limestone from some local source, thus making the farmer independent of Germany for one of his chief fertilizers.

Since the figures of production of pulverized limestone were first compiled in 1911 the industry has steadily increased. The increase for 1916, compared with 1915, was about 32 per cent in quantity and 28 per cent in value. The average price per ton was $1.08 in 1916, 2 cents less than in 1915. The use of the other standard forms of agricultural lime is also on the increase.

Agricultural Ground Limestone

BY RICHARD K. MEADE
Chemical and Industrial Engineer, Baltimore, Md.

Installation of Equipment.

Article No. 3

IN A LARGE quarry where the general run of limestone is pure enough to sell for agricultural purposes, and where this trade is only a small part of the business of the concern, the installation is quite simple and would usually consist of only the crushers, screens and pulverizer. Great latitude would also be allowed in the choice of the latter. Since but a part of the stone is to be ground, only the smaller sizes of the latter need be used and consequently a Griffin or Fuller-Lehigh mills could be used to advantage taking only stone passing the ¾-inch screen. These mills, as I have said, have the advantage over the hammer mill in that they may be made to give a fine product as well as a coarse one.

In this connection, it is well to bear in mind that the fine product is in some demand for other purposes than agriculture, as for example, asphalt filler for paving; and also that while the coarser ground material is now acceptable in most states, the general tendency is towards finer grinding and it is well to be able to meet the demand. The fine pulverizers do not require appreciably more power when grinding to the same degree of coarseness than do the hammer mills, nor are the repairs any greater, but their first cost is higher.

If all of the limestone quarried must be ground, or if only certain ledges are acceptable for the agricultural trade and these can not be used for other purposes either because of the limited quantity available or because the softness of the rock makes it unsuitable for the crushed stone trade, as sometimes happens, the installation will depend entirely on the fineness of product desired. If the product from the hammer mill is fine enough, this mill alone may be employed, but if a fine product is desired one of the pulverizers should be employed proceeding this by a set of rolls, a "pot" cracker, a Sturtevant crusher or a hammer mill — the latter provided with coarse grids set to reduce the material to about ¾ inch (the hammer mill is a very efficient mill for this purpose). Where the rock is soft and there is no gyratory or jaw crusher, a Sturtevant open-door or roll-jaw crusher may be used to advantage, as these will take rock sledged to 6 or 8 inches and reduce to the proper size to feed to the pulverizer.

For a fairly large installation designed to prepare only agricultural ground limestone, we usually suggest a gyratory crusher followed by a small hammer mill and this in turn by a three-roll Griffin or a Fuller mill. This installation will give any fineness of product desired. The hammer mill may be fed directly from the crushers but the Griffin or Fuller mill should be fed from a bin overhead.

Storage of Product

The product from whatever type mill is employed should be elevated by means of a bucket elevator and either spouted direct into the car, when shipped in bulk, or else into a bin when it is to be packed in bags. It will be found of advantage to pass the material for bulk shipment through a pair of automatic scales and thence into the car. This will allow the weight to be taken accurately without recourse to track scales, etc. This same pair of scales may also be ar-

ranged to record the limestone ground into the bin.

In some few plants large storage is provided for ground limestone. This usually consists of a long narrow building with sides properly constructed to withstand the pressure so as to form a big bin. A screw or belt conveyor in the roof of the building brings in the ground limestone, while one in the floor, or in a tunnel under the floor, carries it out. Usually the elevator which carries the product from the pulverizer to the packing bin is so arranged that it may be made to discharge into the screw conveyor leading into the storage, so that material may be either packed as ground or stored. In the majority of plants no storage is provided, however, and the limestone is packed and shipped as ground.

Numerous automatic sacking machines have been tried for packing ground limestone, but so far as I know none are entirely satisfactory and a common plan is to use a spout leading from the bin and a slide, in which case the sacks rest on a scale platform under the spout and the slide is opened until the approximate weight is obtained, the latter being adjusted by means of a scoop. The ordinary sack packer of the type used in flour or grain mills will also be found successful.

Cost of Operation

The cost of pulverizing limestone will depend very largely on local conditions. The power requirements for a hammer mill working on 2-inch material and reducing the same to 10-mesh product will be from 6 to 8 H. P. hours per ton of material ground. That is, a mill grinding 8 tons of limestone per hour will require about 50 H. P. A pulverizer given stone broken down to ¾ inch and under and pulverizing to 90 per cent passing the No. 100 sieve will require about 12 to 15 H. P. hours, or for 5 tons per hour will take 60 to 75 H. P., depending on the hardness of the limestone. The repairs vary from about 2 cents per ton for coarsely ground material to 5 cents per ton for the fine product.

The labor depends entirely on the size of the plant. One man will be required to attend to the pulverizing mill and three men can pack in bags and load from 100 to 150 tons of material per day. In bulk loading, one man is required to prepare the car, trim the pile, etc., for the above quantity. Knowing the cost of quarrying and crushing and given the above facts, the operator who is considering installing pulverized limestone equipment can very readily figure its probable cost to him.

Commercial Considerations

Ground limestone is usually shipped in bulk or in paper or old burlap bags. The paper bags generally are made to hold 100 pounds but the burlap bags vary in size and are purchased second hand — old salt, coffee, nitrate, etc., bags being used. A large burlap bag such as is used for salt will hold 150 to 175 pounds of ground limestone comfortably. If 167 pounds is placed in each burlap bag, twelve bags are required for a ton of limestone.

The price obtained for ground limestone varies largely in different localities but it is probably seldom less than $1.50 per ton and is more generally, particularly now when lime is high, sold for from $2 to $3 per ton exclusive of the package. The latter usually costs from 50 cents to $1 per ton, depending on the price of paper and burlap bags. When burlap bags are furnished these are, as I have said, usually purchased second hand. Just now both paper and burlap are very high. Generally the burlap bags will be repurchased from the farmer

at the same price as sold to him if returned in good condition.

The most satisfactory way to ship ground limestone is in bulk and as it is usually used in quantities of from 1,000 to 4,000 pounds per acre most farmers can afford to purchase a carload at a time.

Indispensable Public Necessity.

THE FOLLOWING opinion of the State Board of Accounts of Indiana relative to maintenance work will undoubtedly do much toward solving the labor question. The highway superintendents for the past several years have been handicapped in obtaining labor, due to the fact that the Highway Superintendents' law was enacted when the price of labor was low as compared with that of the present:

Our country is involved in a great international war, which is now requiring the services of hundreds of thousands of the nation's most perfect type of physical manhood from the various professions, arts and industries, thereby causing a great scarcity of men to perform the usual vocations.

The number that will be required for such war in the future may run into the millions, therefore, wages have materially increased and will further increase in conducting the business of all private corporations and individual enterprises; also, the cost of living has greatly increased, thereby increasing the cost of labor.

Our statutes, which were enacted many years ago (when the cost of living was low), provide $2 per day for chairman, $1.50 per day for axemen, $2 per day for superintendent of construction of gravel roads (and such superintendents have to furnish a $5,000 bond); $1.50 per day for labor to repair gravel roads and $3.50 per day of ten hours for man and team to repair gravel roads. In a large number of counties it is impossible to employ such help at the statutory price. Nobody can be compelled to accept a lower wage for any of such work than can be had for similar services from private corporations or individuals.

Therefore, during the present crisis, with its abnormal business conditions, it becomes absolutely necessary that proper officials having authority to employ such help may meet the competitive market demands by reason of the present national crisis in such counties where wages have materially increased on account of such crisis, until the Allies have been victorious and normal conditions have been restored.

Necessary action by proper officials in good faith, along the lines suggested as an indispensable public necessity, will not be questioned by our examiners. Of course, any extortion either directly or by subterfuge will not be allowed as a proper charge by this department.

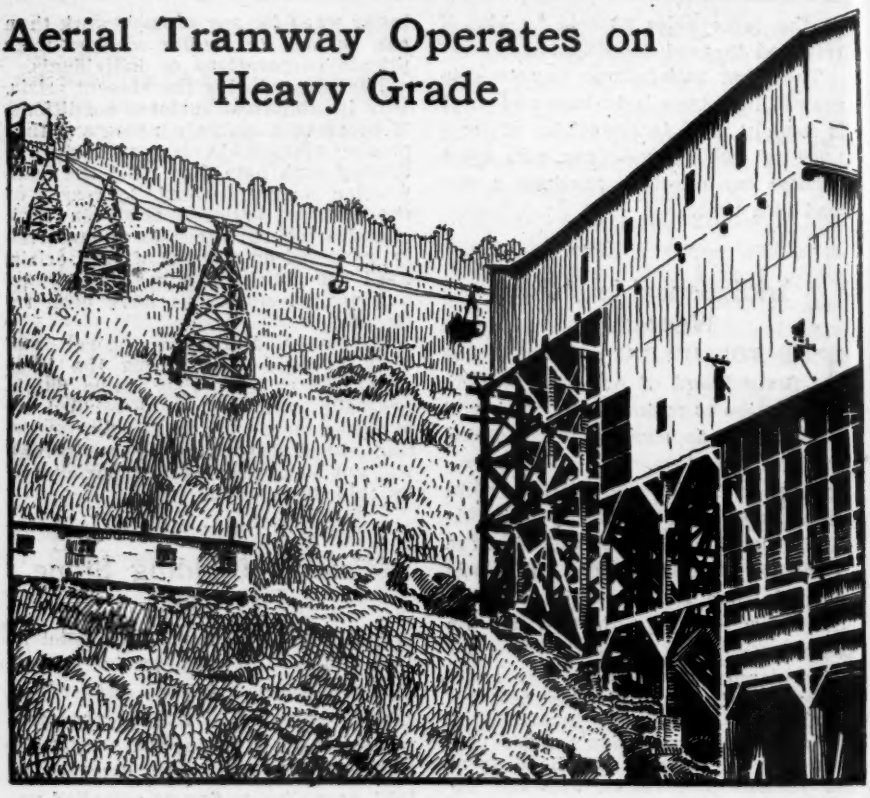
Missouri Building Stone Decreases.

MISSOURI, which ranks second to Indiana in the production of limestone for building and which showed gains of 17 and 25 per cent, respectively, in value of output in 1915 and 1916, suffered a decrease in 1917, according to figures compiled under direction of G. F. Loughlin, United States Geological Survey, Department of the Interior.

The decrease, which was caused by curtailment of building operations due to the war, began in the spring of the year and has since reached a point where erection of permanent high-grade buildings by private interests is now practically at a standstill. Selling prices increased slightly in 1917 but were not sufficient to offset the increased cost of production.

PIT AND QUARRY gives an idea in a few pages how the other fellows are running their places and how we may make improvements to ours, according to our markets. I have spent days going from city to city and hunting out the sand banks to find new ideas and then be disappointed in what I found.—Jay W. Robinson, Auburn, N. Y., R. D. 7.

Aerial Tramway Operates on Heavy Grade



Quarry and Crushing Plant Are Five Hundred Feet Above the Screening House at the Railroad.

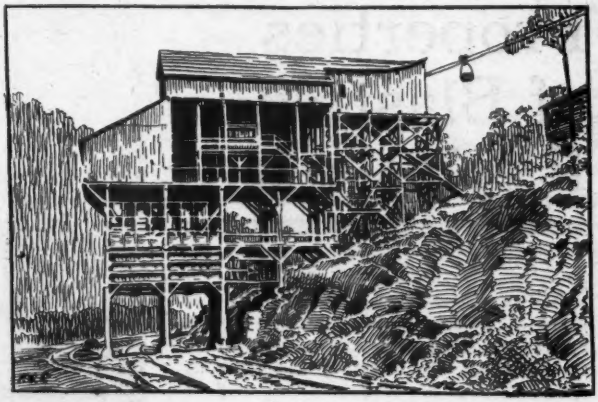
ROUGH COUNTRY and a 50 per cent grade caused by the location of the quarry and crushing plant 500 feet above the screening house at the railroad have been overcome by the Leschen heavy duty friction grip aerial tramway at the plant of the Casparis Stone Co., which is developing a bluestone quarry south of Connellsville, Pa., on the B. & O. railroad. The distance between quarry and screens is 1,100 feet.

A surface incline was considered, but was considered out of the question, inasmuch as a very high trestle would have to be erected at the lower end and the initial expense and general upkeep cost would be excessive.

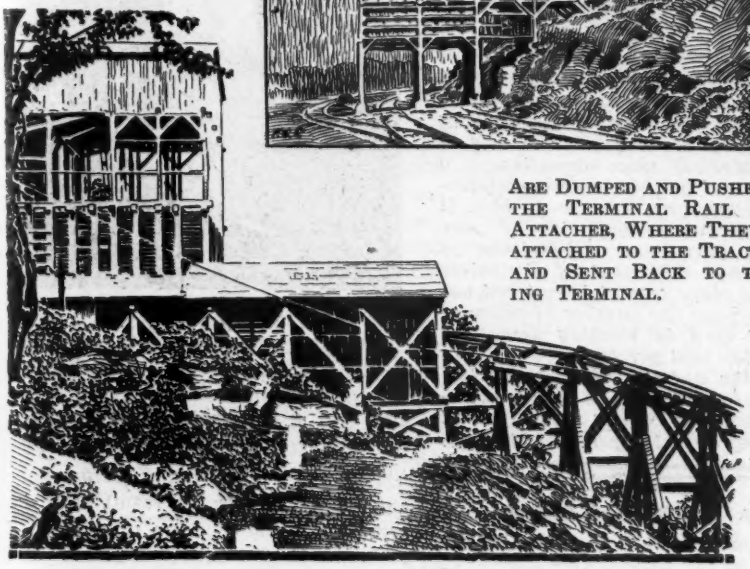
Big Hourly Capacity

A large hourly capacity was required—150 tons, weighing about 100 pounds per cubic foot in the form in which it is carried over the tramway — and the grip on the rope is of first importance. The screw type is used, and although the grade is heavy and the pull of the 20-cubic-foot (1 ton) bucket strong, yet the equipment has withstood these admirably.

After the carriers are loaded through a special chute attached to the storage bin, they are pushed by the operator into the automatic attacher, which is so arranged that the



BELOW IS THE LOADING HOUSE, WHERE THE CARRIERS ARE ATTACHED TO THE TRACTION ROPE. PROCEEDING TO THE SCREEN HOUSE AND STORAGE BINS, SHOWN AT THE RIGHT, THE CARRIERS ARE DUMPED AND PUSHED AROUND THE TERMINAL RAIL INTO THE ATTACHER, WHERE THEY ARE REATTACHED TO THE TRACTION ROPE AND SENT BACK TO THE LOADING TERMINAL.



grip clamps the traction rope, and the carrier then proceeds to the discharge terminal where it is automatically detached from the traction rope and proceeds on the overhead rail to a point where another man receives it and dumps its load into the hopper above the screens.

The carrier is then pushed around the terminal rail into the attacher, where it is reattached to the traction rope, and then proceeds back to the loading terminal.

The carriers are spaced 200 feet apart, the entire number being kept continuously in motion, the spacing being regulated by means of an automatic gong at the loading terminal. The aerial equipment was furnished by A. Leschen & Sons Rope Co., St. Louis, Mo.

EVERY YEAR in the United States there is burned up enough property to pay the interest on three Liberty Loans. In 1917 the loss was $267,560,740, nearly all of which was due to carelessness. Burned buildings in one year would line a street on both sides reaching from New York to Chicago. It takes a barrel of flour and other ingredients to make from 250 to 265 loaves of war bread, and yet one elevator fire destroyed 3,000,000 bushels of wheat. Foodstuffs destroyed would feed starving Europe. The money lost would have killed the U-boat menace or darkened the European skies with aeroplanes and prepared a clear path to Berlin. And yet really fireproof construction is hardly ever considered except for large buildings.

Properties of Blasting Explosives

If you are using more than a third of a pound of explosives per ton of stone taken from your quarry there is room for improvement, and a thorough study of explosives and careful observation of the blasting methods in effect on your work ought to result in lower costs. If your operation is a large one and neither your superintendent nor you have time to do this, it would pay you to give one of your engineers permanent supervision of the blasting. The cost of explosives per ton of stone cannot be worked out by multiplying the number of boxes of dynamite used in blasting down the stone by the cost per box and dividing that by the number of tons blasted, because often nearly as much explosive is used in doby shooting and blockholing as in the primary blasting.

By Willard Young
Atlas Powder Co., Wilmington, Del.

BLASTING EXPLOSIVES contain a large amount of expansive energy that can be used to perform mechanical work. The properties that govern their action are strength, velocity and volume. The other properties demanding consideration in their use are water resistance, cold resistance, sensitiveness and durability under normal storage conditions. Other factors that affect the work of explosives are the compactness or density of the charge when in place and the degree and distribution of resistance. The former has an important influence on the completeness of detonation.

An authority says in regard to this: "Insufficient initial impulse (the use of a weak detonator with a slightly insensitive explosive) or interrupted propagation of the explosive reaction as might be caused by loose loading or the separation of a charge in a bore hole by an intervening stone may, and probably often do, result in an incomplete transformation of gases and correspondingly lower pressure and smaller effect. Sometimes there is an incomplete and less efficient reaction due to light resistance. Pressures are largely affected by the density of the load."

A PERFECT BLAST.

DEVELOPING AND APPLYING ENERGY.

In regard to developing and applying the energy of blasting explosives when using them the same authority says: "Definite statements as to effect produced by a given explosive cannot as a rule be made. The course of the explosive reaction, and more especially the velocity of the physical character of the development, are dependent not only on the chemical and physical character of the explosive itself, but to just as great an extent upon the character of the surrounding medium

whose resistance is to be overcome. The actual utilization of the potential energy in an explosive is, as a rule, surprisingly small, probably not amounting to more than 15 or 20 per cent." If you are losing 80 per cent of the potential energy of the explosive you are buying, here is a matter demanding prompt and thorough investigation.

As information in regard to the strength, velocity, volume, water resistance, cold resistance, durability and under some conditions as to fumes and sensitiveness is of much importance to you, and as you are largely dependent on the manufacturer for this information, it is altogether right and proper for you to ask him to suply you with it in regard to each of the explosives that he produces.

The Strength Standard.

The strength standard was originally based on the proportion of trinitroglycerin in a mixture of trinitroglycerin and clay having high absorbing power, the clay, of course, being an absorbent only and remaining inert when the trinitroglycerin exploded. Subsequently the standard was made from 10 to 20 per cent higher in this country by replacing the clay or kieselghur with pulp and other non-explosive but gas producing substances. This strength standard is still ostensibly adhered to by most manufacturers, even though their products may contain little nitroglycerin or none at all. There are, however, some exceptions to this in which the graded strength represents the percentage of explosive ingredients other than nitroglycerin.

Standard blasting high explosives range in strength from six or seven to 102 or 103 per cent. That is, the weakest one, that known as R. R. P., is as strong as dynamite having six or seven per cent of trinitroglycerin as its only explosive ingredient, and the strongest one is two or three per cent stronger than trinitroglycerin.

It is difficult to determine an accurate strength relation between dynamite and blasting powder because the latter, which is a low explosive, takes so much more time to transform from a solid into gases. Blasting powder is usually said to be about half as strong as R. R. P. We are often told that the best way to determine the relative strength of explosives is by a comparison of the work they will do in blasting, but this does not always apply, as under some conditions and in some blasted best with a dense explosive while a bulky one is most effective in other stone.

It is not necessary to ask the manufacturer for information about the volume of explosives, because you can readily determine this for yourself by counting the number of cartridges of a given size contained by a 25 or 50 pound case. Standard sizes of cartridges are 1 inch, 1¼ inches, 1½ inches, and 2 inches in diameter, by 8 inches long. If you measure carefully you will find that some are from a quarter to a half inch shorter and an eighth of an inch smaller in diameter than these standards. This must, of course, be noted when comparing the volume of two explosives. The densest high explosives have about 85 and the bulkiest about 160 1¼x8 inch cartridges to the 50-pound case. In view of its importance more consideration should be given to the volume of explosives.

High explosives used for blasting are made in 16 standard strengths, 18 velocities differing by 500 meters per second and eight volumes differing by one-tenth. Theoretically this would give us 2,300 explosives having enough difference in action to demand consideration. This number should be reduced by about one-half, because

only the denser explosives can be increased in strength without also increasing the velocity. That is, we do not find in use bulky and moderately bulky explosives of high strength and low velocity.

You have doubtless decided approximately the most economical strength of explosives for your work. You have also probably decided whether a quick or a slow one works best, but have you ever tried, for example, a strong, slow, dense one or a weak, quick, bulky one, or any of the other six combinations of maximum and minimum strength, velocity and volume. Remember that prices of explosives are in a general way regulated by their strength and not by variations in velocity and volume. An increase or decrease in velocity or volume might easily increase the efficiency of your explosives and would cost you nothing. It may be that a quicker or bulkier explosive of 5 or 10 per cent lower strength than the one you are using, and accordingly considerably cheaper, would do your blasting just as well or better. Or perhaps you ought to use a denser and slower one or a denser and quicker one.

Testing Is Only Means of Choosing Proper Combination.

There is no rule of thumb to determine what combination of strength, velocity and volume will most effectively blast different material and the most experienced blaster can only determine this by constant attention and a good deal of testing. If strength were the only factor to be considered an experienced blaster could tell pretty well by looking at the stone what kind of explosives to use, but he does not know without testing intelligently whether a strong and dense explosive would do better than a weak, bulky one.

The strength and volume of any explosive can easily be determined by examining the markings on the case or cartridge and weighing cartridges of a given size or counting them to find out how many there are in a case. In regard to the strength grading it is well to learn from the manufacturer whether the strength is graded on the nitroglycerin standard, as it should be, or whether it is actual percentage of explosive ingredients. Approximate or relative information in regard to velocity of

Some Necessary "Dont's."

Don't expect the shot to come out properly at the toe if 20 feet of broken stone from the last shot is standing against the face.

Don't forget that mudcapping or doby shooting is the most extravagant and wasteful kind of blasting.

Remember that the grade of explosive best for the bore holes is probably one of the least economical for mudcapping and may not be suitable for blockholing. Also remember that a grade of explosives that did excellent work when you were using plug drills may be far from economical in well drill holes.

Don't get the idea that the best explosive in one quarry is necessarily the best in another quarry a mile or two away. Very slight difference in the quality or position of the stone may make it blast quite differently.

Don't expect the stone to come out as well when it dips back from the face. Don't expect as good breakage when it pitches back from the face.

Don't forget to test every electric fuse with a galvanometer before loading it and don't forget to test the circuit with a galvanometer or Wheatstone bridge before you try to fire.

Don't forget to test out your blasting machine with a rheostat before every shot.

Don't forget to use waterproof fuses in wet work.

detonation can always be secured from the manufacturers.

GELATINS ARE THE DENSEST.

The densest high explosives in general use are the gelatins. Excepting the 80 per cent and 100 per cent grades they are among the slowest unless detonated with a straight nitroglycerin dynamite primer, and they are the most waterproof. When a straight nitroglycerin dynamite primer is used they detonate with approximately the same velocity as the primer does. The gelatins, when properly detonated, give straight nitroglycerin grades in which the only explosive ingredient is nitroglycerin. The velocity of both of these classes increases with their strength.

The quickest acting and strongest high explosive in general use is blasting gelatin, 100 per cent grade, which, like the other gelatins, is waterproof and without harmful fumes. The "extra" grades resist water better than the R. R. P. and other black dope "low powders," but not so well as the straight nitroglycerin grades which are in turn surpassed in this respect by the gelatins. The straight nitro-

SMOKING

Or the carrying of matches while handling dynamite is strictly prohibited. Be careful.

We Tell Our Men

To handle dynamite as they would a box of eggs which they own themselves and not wish to break.

DYNAMITE

Men unloading cars or working in magazines are required to wear rubber shoes

off the least harmful fumes, but as they are a little less sensitive than some of the other dynamites, especially when they are old, they must be compactly charged and exploded with a strong detonator to prevent partial detonation, resulting in inefficient work and bad fumes if the blasting is underground.

ACTION OF BULKY EXPLOSIVES.

The bulkiest high explosives are R. R. P., and the permissible explosives of the Miners' Friend and Coalite classes, which often give excellent results in quarry blasting. They are not water resisting and are the slowest in detonation, being closely followed by the gelatins up to 60 per cent, and other standard explosives under 30 per cent. Those dynamites known as the extra grades, in which a small amount of the nitroglycerin is replaced by ammonium nitrate, are slower than the glycerin grades are a little more sensitive than the others.

TO GUARD AGAINST LOSS.

While you are working out the strength, velocity and volume problem don't forget that rock conditions change sometimes very suddenly and with little if any surface indications, requiring a change in explosives, and above all don't forget that you can lose more money through deterioration of explosives because of improper storage; through imperfect detonation, due to weak or damp detonators, loosely packed charges, or chilled or frozen explosives; through the loss of efficiency of "low powders" and "extras" in wet work and through improper location and depth of bore holes, than you can in any other way. A cool, dry, fireproof, bullet-proof magazine for your dynamite and a small one for your detonators cost

about one-tenth as much as the explosives and blasting supplies they will hold. Low freezing explosives that are exactly the same excepting in their cold resistance as the high freezing ones, do not cost any more, and do not chill and lose efficiency when they are loaded in cold weather.

Keep your quarry face or your ledge straight and plumb. Don't have it hollowed out like an arch with both ends tied in to side walls and with 10 to 15 feet more toe than top on your bore holes. Remember that it sometimes pays better to bring out the face in fairly large size and to blockhole or plug it afterward than to try to bring out and break it up at one time. A double row of holes generally breaks the stone better, but cannot lift it out as cheaply because much of the forward pressure of the charges in the back row is exactly counterbalanced by the back pressure of the front charges.

Bookkeeping

How the Operating Results of the Business Are Shown in the Profit and Loss Account.

BY EDWIN L. SEABROOK

Article 2.

THE ARTICLE in June on this subject, mentioned a number of things that the books of those engaged in the sand and gravel, crushed stone business and kindred lines should show. It is now proposed to briefly describe the Double Entry system.

The mention of "double entry" bookkeeping seems to frighten many who have had little bookkeeping experience. They associate it with intricate, complicated forms, much clerical work and no little mystery. There is nothing complicated about the double entry system. It is simple enough when once the nature of debits and credits (buying and selling) is understood.

The term "double entry" comes from the fact that every account is entered twice—once as a debit and once as a credit. Practically every business transaction relates to two things—selling by one, and buying by another. Where there is a sale there must be a buyer. If the Eureka Quarry Co. buys machinery for $652 from the Royal Machinery Co., one is a debtor and the other a creditor, both for equal amounts. Where there is a debit there must be a corresponding credit. Double entry makes use of both in every transaction to produce the *results*.

Representative Accounts

In order to make these double entries there are two classes of accounts — PERSONAL and REPRESENTATIVE. The personal accounts are with individuals, firms or corporations, and opened in the name of such. Representative accounts are with things which represent persons, etc., in the various business transactions. Material purchased represents something (or somebody) for which money is spent, the same also of rent, salary, labor and other items. These are not accounts with persons, hence not personal but representative accounts.

These representative accounts can be charged with what is paid out for them and credited with what they produce. Some one may ask: "What do these accounts produce by which they can be credited? Not being personal, how can they pay anything back?" A complete explanation would be rather lengthy, but these accounts do produce, although it is representative. Material produces profit or loss, and can be so credited. Rent, telephone, office help, etc., produce expense, and can be charged with such

Journal

Double entry does away with the Day Book, or at least that book is not necessary, and uses the Journal as the original book of entry. The Journal is ruled the same as the Day Book,

and the items are entered therein the same, with the exception that the debit and credit entries, representing the transactions, are made at the same time.

Let us take the single entry of Wm.

September, 1917		Dr.		Cr.	
15					
Wm. Andrews		$248	80		
To Orders				$248	80
" 30 tons of sand @ $1.50	$45:00				
" 16 tons of gravel @ $1.55	24.80				
" 60 bushels of lime @ 40¢	24.00				
" 50 tons stone @ $1.85	92.50				
" 25 bbls.Port.Cem.@ $2.50	62.50				

Andrews, in the day book, shown in the June issue. It will be seen that Mr. Andrews is debtor to certain kinds of material. This is a personal account, the entry made but once, hence single entry. As every business transaction produces a debtor and a creditor, and as Wm. Andrews is a debtor, something or somebody must be a creditor for an equal amount. In this case it is the owner of the business. Instead of his name a representative account termed ORDERS is used. This account represents the amount of business coming in, whether in the form of orders, sales, contracts, etc. The word "Orders" in this connection is the name of an account and should be credited with sales, contracts, etc.

Orders				Cr.
Sept	15	By Wm. Andrews		$248 80

The Journal entry of Mr. Andrews for his material would be made as shown in Fig. 1.

An account with Orders is opened in the Ledger, as shown in Fig. 2.

It should be noted that Wm. Andrews has been charged with $248.80 in his PERSONAL ACCOUNT, and credited with it in the ORDERS ACCOUNT, making it a double entry.

In the same manner an account can be opened with MATERIAL, which can be charged with all material purchased.

The productive labor account can be debited with the amount of pay roll for productive labor.

An account with TELEPHONE RENT, POSTAGE, HAULING, SUPERINTENDENCE, INSURANCE and other items of expense can be opened and charged with the cash paid for them. The same for the salary paid the proprietor and office help.

Dr.		Profit & Loss					Cr.	
Sept	30	To Bad Debts	$25	76	Sept	30	By Orders	$2099 17
		" Expense	352	50			" Deficit	54 55
		" Depreciation	7	00				
		" Productive Labor	644	18				
		" Int.& Discount	4	82				
		" Material	1119	46				
			2153	72				$2153 52

The EXPENSE ACCOUNT can be debited with the amounts spent for these various accounts when the Ledger is closed at the end of the year.

In order to give the operating *results* of a business, this will be taken hypothetically for one month. This period of time will do just as well as for a whole year, because all the transactions of producing, paying labor, rent and other expenses are necessarily involved. A longer period would only multiply the various transactions.

During a given month the various transactions were:

Received orders, or contracts, amounting to $2,099.17.
Purchased material amounting to $1,313.27.
Paid cash for one bill of material, took the usual discount, amounting to $2.54.
Paid for productive labor, $644.18.
Paid for overhead expense, including salary, $352.50.
One account, amounting to $25.76, proved worthless, had to be charged off.
One sale was paid for within ten days, the buyer taking the usual cash discount, amounting to $7.36.
On the last day of the month the inventory of material on hand was $193.81.
Depreciation was charged off to the amount of $7.00.

This is the brief history of a summary of the various transactions during the month. We will now consider the various accounts that should be opened.

An account should be opened with MATERIAL. This should be debited with the various amounts purchased or produced during the month. If any material was on hand at the time the account was opened, it should also be charged with this amount. When the books are closed this account should be credited with the amount on hand, which can be ascertained only by an inventory. It should be balanced by crediting it with profit and loss for the actual amount of material or merchandise used, which, in this instance, is $1,119.46.

An account with ORDERS should be opened and credited with all orders, sales, contracts, etc. This account represents the amount of business transacted for the given period. The account is closed by debiting it with profit and loss.

The PRODUCTIVE LABOR account should be charged with the amounts paid for this item and closed by crediting it with profit and loss.

The EXPENSE account should be charged with the amounts of the overhead, and closed by crediting it with profit and loss for the total amount of these.

It is well to open a Ledger account with each of these overhead expense items, charging the account for the amount expended, closing it by crediting with EXPENSE, and carrying this amount to the EXPENSE ACCOUNT.

As one sale, amounting to $25.76, proved uncollectible, this should be placed on the debit side of the PROFIT AND LOSS account.

As discounts were given and received an INTEREST AND DISCOUNT ACCOUNT should be opened, charged with the discounts given and credited with those received. The difference should be carried to the PROFIT AND LOSS account, which, in this instance, is $4.82, on the debit side, because more was given than received.

It remains to determine the status of the business at the time the books were closed. We will illustrate with only one representative account, PROFIT AND LOSS, because this fully discloses the operating results for the given period. This is charged with every item that cost the business something, and credited with everything that produced something for the business.

This account determines whether the business has been conducted at a gain or a loss, and is therefore the last one to be closed.

An analysis of this account shows that it contains the total of all business transactions (and the results) for the given period.

As it cost $2,153.72 to produce the business, and as the amount of orders was only $2,099.17, the business was transacted at a loss, of $54.55.

The last account in the Ledger is DEFICIT, which is debited with the balance of PROFIT AND LOSS. This account cannot be balanced until the profit equals or exceeds the amount of the deficit, although it can be charged off to capital, which would show an impairment. If the income of the business had exceeded the outgo, this account could have been termed SURPLUS, and credited with the amount of profit.

Of course, a combination could have been selected that showed a profit instead of a loss. Much of the bookkeeping does not show the losses or the gains. This is the great object of bookkeeping — to determine the results of the business, and to trace *why* the loss occurred. A business man is far more inclined to analyze his losses and the reasons for these than his gains.

I HAVE always seen the need of a publication like PIT AND QUARRY as there is much to be done to put the industries on a firm footing as regards the operation of plants and quality of the materials produced.—Tacoma Sand & Gravel Co., Tacoma, Wash.

Methods of Breaking Up Boulders

A Discussion Listing Six Ways of Breaking Rock Economically

By D. J. HAUER, C. E.

IN EVERY QUARRY operation one of the great items of expense is the breaking up of boulders. No matter for what purpose the quarrying is done, there is always boulders to be handled and broken up. In all there are six different methods of boulder breaking in rough dimension and crushed stone quarries.

1. Plug and Feather.
2. Derrick and Ball.
3. Sledging.
4. Block Holing.
5. Mud Capping.
6. Undermining.

The first three methods are without the use of explosives, while in the last three explosives must be used.

Plug and Feather

This method consists of drilling a series of small diameter holes a few inches apart across the face of a boulder, after which two feathers, pieces of half-round iron, are placed in each hole, and the plugs or wedges are driven in between the feathers. The gradual driving of these plugs along the entire line of holes splits the stone. It is by this method that building blocks or any rough dimension stone can be gotten out. At one time, when it was necessary to drill all the holes by hand, this method was both slow and expensive, but this has changed decidedly since the hand-power drills have come into use. Now these holes are drilled rapidly, as the power drills blow out the dust as they cut the holes, and the drills can also be used for driving the plugs. This method is not used for rough stone, while the other five listed are.

Derrick and Ball

This was an economical method of breaking boulders of from one to four cubic yards in size, and still is under some conditions, but the small power drills have so materially changed boulder breaking that this method no longer gives promise of such an extensive use as it once did. It can only be used in quarries where derricks are employed. The method is to raise up a large metal ball or weight on the boom of a derrick, directly over a boulder and by means or a trip the ball is dropped some 40 or 50 feet, striking the boulder a blow, just like a huge sledge. It is by repeated blows that the boulder is broken.

The description is simpler than the operation, for the derrick boom must be centered exactly over the boulder, and the ball must not swing, else it will miss the rock in dropping. The usual method of procedure is to use the derrick, when it is not employed for other purposes, to pick up large boulders from the mass of blasted rock, and set them to one side, where they are temporarily out of the way, so that later they can be broken. One means of making the breaking easy is to place the boulder on a few spalls or fair-sized stones so as to give a hollow space under the boulder to be broken. It is also possible to have a special place where two or three boulders can be placed for breaking, break them, pick up the pieces, and then place new ones.

Sledging Boulders.

The limit of sledging boulders is generally a cubic yard in size, and for hard fire-made rock, as trap and granite, about half a cubic yard. Not only the character or kind of stone governs this, but also the size and shape of the boulder. A flat stone of large size can be broken easier than a round boulder of half the size. There are two decided helps in breaking boulders. One is to keep a hollow space under the boulder by using small stones under them, and the other is the use of gads. These gads can be made either with a heavy square point or wedge-shaped. Heavy wire handles can be twisted around the gads to hold them so that one man can hold the gad while another strikes. The gads make the sledging of rock very much easier work and save much drilling and explosives. The use of sledges in some quarries is carried to extremes, where explosives would be cheaper, but in most quarries it is the opposite; that is, sledges are not used enough.

With the help of the proper kinds and sizes of gads, it is possible to break up a very large number of fair-sized boulders by sledges for much less money than by any other method. A record of the cost of boulder breaking kept over a number of years showed that sledging was the cheapest method up to about three-quarters of a cubic yard. When stone is mucked out of the blasted pile of rock and loaded into cars by men on a tonnage basis, this sledging up of boulders does not cost the quarryman anything extra, for the rock breaking is included in the cost of loading.

One fault with sledging is that of using too heavy a hammer. Some quarrymen go upon the principle that if a heavy hammer is placed in a man's hands, every time he gives a blow with the sledge he must do some work. This is an erroneous idea. If a hammer of fair size and weight is given to a man he will use it with such ease as to gain some skill and accomplish results. A heavy sledge is the means of a man hiding his inclination to loaf. In other words, it is a lazy man's tool.

Most men will do the best work with sledges weighing from 12 to 16 pounds. A few can use 18- and 20-pound hammers. These last-named are too heavy for most workmen. It is frequently advantageous to furnish a sledger with two different-weight hammers.

Block Holing

Generally speaking, block holing is the most efficient and cheapest method of breaking up boulders with explosives. It consists of drilling a hole in the top of the boulder, just above the center of the mass, and placing a charge of explosives in this hole, covering it, and exploding. Mud or any heavy, wet clay is generally used for the covering. The dynamite being placed down in the mass of rock breaks the boulder itno a number of pieces, so that these can be used with but little sledging.

At one time, when most of the drilling in boulders had to be done by hand, this method was considered slow, and the cost of the drilling was quite large as compared to the cost of the explosives, so that drilling was only done on the largest boulders. With the many power hammer drills now on the market holes a foot or less in depth can be drilled both cheaply and quickly. This has so changed boulder breaking that many small boulders can now be broken up by this method economically.

For small boulders, and even for large ones where the saving of time is of value, the hole need not be drilled to such a depth as to take the entire charge of explosive, but only about half. This will not give as good re-

sults as entirely embedding the charge, but will be better than mud capping.

Mud Capping

With the mud capping method the rock is not drilled but the charge is placed on top of the boulder and mud used to cover it. The stone is broken up but the cost for explosives is high, as much of the energy released goes into the air and thus causes a loud report. This method was at one time the most common one in use for boulder breaking, but with the advent of the power drills, previously mentioned, it is not now used so extensively.

The fact remains that there are still cases when mud capping should be brought into play, for it is the quickest method of getting rid of a boulder, even quicker in some cases than undermining boulders. A large blast is made, and the work of picking up can not be started until a number of large boulders are broken. Then mud capping must be done. When time is not an object, block holing can be resorted to, as it is cheaper.

Undermining Boulders

Undermining is a method not much used, yet it is to be preferred for cheapness to mud capping, except in a few cases. It is not as cheap, though, as block holing. The method consists of placing the charge of explosives under the boulder, surrounding it with mud and exploding. The fact that the charge is better confined than in mud capping saves from one-quarter to one-half of the charge over that used for the same boulder, when mud capping. To successfully use this method the rock must lie on a hard bottom, otherwise the blast is not likely to be as effective as mud capping. Boulders resting on a mass of blasted rock cannot be broken up so easily by this method.

In some cases a bar will make a hole under the boulder to receive the charge. In other cases it may be necessary to raise up the boulder on one side with levers, place the charge of explosives and the mud and let the boulder down onto the charge.

The writer has used this method very successfully. The report from the blast is not so loud as in mud capping, but this method of blasting throws large pieces of the boulder in the air, when placing the charge on top is not so likely to do so. The report is louder than in block holing, and throws the rock in a similar manner. Undermining boulders is not as cheap as breaking them up by block holing.

Phosphate in Kentucky.

IN KENTUCKY there is a phosphate field that is practically undeveloped. It is near Midway, Woodford county, but phosphate rock is found also in Lexington, Fayette county, and in Scott, Franklin, Jessamine and Clark counties. The deposits near Midway and Lexington are the most valuable.

Samples of phosphate rock from 100 drill holes were analyzed in the laboratory of the United States Geological Survey and proved to be of high quality. There is also a large amount of lower-grade rock which will have to be washed before it can be marketed. There is an abundance of flowing water in the region and this fact and ample railroad facilities make the Kentucky field worthy of attention.

ENJOY every page of Pit and Quarry. We know from experience that there is a wide field open for the introduction of your latest Eastern improvements into our Western states and your journal should be made a directory as well as the interesting periodical you have already produced.—Roseburg Sand & Gravel Co., Roseburg, Oregon.

ASSOCIATION ACTIVITIES

Mid-Summer Meeting.

NEARLY the entire membership of the newly formed Ohio Sand and Gravel Producers' Association met at the Breakers hotel, Cedar Point, O., July 9-10-11 for their mid-summer convention. The interesting program and big attendance was largely due to the efforts of Secretary Guy C. Baker. R. F. Casey, of the State Industrial Commission, in an interesting address spoke of industrial insurance bearing directly on the sand and gravel industry.

GUY C. BAKER

Executive Secretary, Ohio Sand & Gravel Producers' Assn., Greenville, Ohio.

Clifton C. Cowen, State Highway Commissioner, and E. Guy Sutton, secretary of the National Association of Sand and Gravel Producers, who were slated to deliver the principal addresses, were both unable to attend because of their being in conference with government highway officials in Washington. Car supply, freight rates, and war conditions were generally discussed and the members took advantage of the outing facilities afforded by the famous watering place.

Government Zone System

R. L. HUMPHREY, of the War Industries Board, has suggested a joint conference of stone, sand and gravel producers with the object of organizing these industries into districts or zones for the purpose of making an equitable distribution of government purchases and the supervision of labor, fuel, etc. The government has already investigated production cost in some plants.

This meeting is being held at the Willard hotel, Washington, D. C., as we go to press (July 31). The building stone men met in New York, July 19 and divided the United States into six groups. Details of the zone system will appear in the September issue of PIT AND QUARRY. The lime industry has already been divided into fourteen districts.

Lime Manufacturers Meet.

ABOUT 100 lime manufacturers met at Cleveland, Ohio, June 19-20 and substantially strengthened and reorganized the National Lime Manufacturers' Association. The new name of the organization will be "The Lime Association." It will comprise fourteen geographical districts with one director from each district.

William E. Carson was unanimously elected president of the new association. He fulfilled the presidential duties of the original association for ten years and worked hard to bring about the reorganization. New con-

stitution and by-laws were adopted, the principal feature of which being the agreement of the members to bind themselves to pay four cents a ton of production.

May Lower Freight Rates.

THE COMMITTEE on Railway Control is considering a 50 per cent reduction of the increased freight rates on crushed stone, sand and gravel established by Order 28 on May 27. At a meeting July 10 with municipal officials, road contractors and material men, held in the office of Logan Waller Page, director of the United States Office of Public Roads and Rural Engineering, and chairman of the new United States Highway Council, the protest of the road builders was carefully considered and the conditions set by the order given such attention as bids fair toward the adoption of reasonable relief measures.

The Railway Control Committee certainly gave out the impression that it would lower the 20-cents-a-ton increased rate to 10 cents a ton, but stated that no refunds to contractors would be made on contracts made prior to the issuance of the order. The committee was also asked to authorize a refund on material delivered after June 25, but beyond promising to consider the request gave no assurance that the same would be granted.

The railway board suggested that each state enact laws to permit the state, county, township or city to pay this extra freight charge, as has been done in Maryland. If this should be done, and the government reduces the rate increase 50 per cent, it will allow road and street work to go ahead without the extreme hardship to contractors which Order 28 imposes on them.

Government's Road Program.

THE UNITED States Highways Council, announcement of the formation of which appeared in the July issue of PIT AND QUARRY, at a conference in the office of L. W. Page, U. S. Director of Public Roads, July 10, with road contractors and material men, stated that it favored (1) program of maintenance, (2) repair and resurfacing, (3) completion of existing contracts and (4) new construction where necessary for military needs.

"As far as possible important highways already constructed should be maintained," the council declared, "and those should be constructed which are of vital importance because of their bearing on the war. These may be summarized as follows:

"Those which are utilized or will be utilized by the military establishment.

"Those which carry considerable volume of material and supplies essential to war industries.

"Those which have a bearing upon the production and distribution of food supplies."

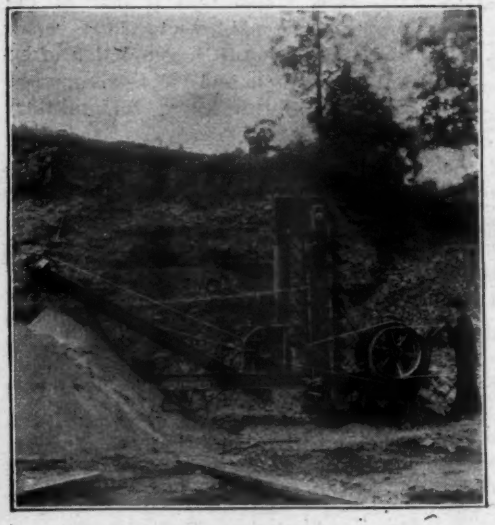
As announced by Secretary A. P. Sandles, who attended the conference, in Bulletin 7 of the National Crushed Stone Association, the Highway Council considers that it is now time for the state highway departments to take up with county and township units the program for 1919 and by October 1 every state highway department should be ready to submit a prepared program to be gone over, pared down if necessary, by the Highway Council.

Maintenance and resurfacing of existing highways are to be the high spots, for in many states road funds collected by law for new construction may be transferred to maintenance improvements and resurfacing.

MEN AND MACHINERY

One-Man Crusher.

THE PORTABLE crusher pictured here is known as the L. B. H. Hummer and is a one-man operated machine. The letters L. B. H. indicate: Low feed, which allows the operator to stand on the ground and feed the machine without assistance; Big receiving openings of 12 by 7 inches, and High discharge, which enables the loading of material direct into a wagon or a lime spreader.



The machine is for pulverizing limestone and is of heavy design. The crusher has a steel frame cast in one piece and is fitted with manganese steel jaws. Underneath the crusher there is an automatic feeder which feeds the elevator. The elevator discharges into a spout which feeds the pulverator. From the pulverator the material discharges into a screw conveyor or loader where it is elevated to a high point and discharged into a wagon or spreader.

This machine weighs approximately 8,000 pounds and has a capacity from 1½ to 3½ tons per hour, requiring 15 to 25 H. P. to operate. It is claimed that it will pulverize limestone from a size as it enters the 12 by 7-inch crusher to any fineness wanted down to 90 to 95 per cent passing a 20-mesh sieve. The machine is manufactured by the Allis-Chalmers Mfg. Co., Milwaukee, Wis. The company offers to make chemical tests of the limestone of prospective purchasers without charge.

The Traylor Engineering and Mfg. Co., Allentown, Pa., announces the election of Samuel W. Traylor, formerly president, as chairman of the board; William J. Roberts, formerly vice-president and general manager as president; and H. Battersby, formerly treasurer, as vice-president and treasurer.

A Niedermeyer, for many years connected with the Worthington Pump and Machinery Corporation, most recently as works manager of the Snow-Holly Works of that corporation, at Buffalo, N. Y., resigned on May 31 to devote his entire time to enterprises of his own.

Du Pont's Great Achievement.

A MOST illuminating story of achievement in this world war, foresight in preparing for America's participation and immediate readiness to supply all our Government's demands for explosives and many other needful articles was told to a few hundred du Pont employes at their recent sales convention by Colonel E. G. Buckner, vice-president in charge of military sales of the company. He showed that the work done by the company in supplying powder to the Allies has been credited with having saved the British Empire.

Efficiency and perfect organization, he said, made it possible to supply a total of 1,500,000,000 pounds of explosives for war demand. The same efficiency and organization which did

this made it possible also for the du Ponts to answer America's calls and to keep the powder train moving to the American trenches just as it had moved on scheduled time to supply the British and French and all others. Not only has the du Pont company contributed ammunition, but 4,168 employes are in the ranks.

Strong Detonators Best.

ALWAYS USE strong detonators, at least No. 6 electric blasting caps and, better still, No. 8. In all holes at least two detonators should be used. A good rule to follow is to place a detonator every 25 feet in the explosive charge. If it is necessary to splice extra lengths to electric blasting cap wires, the joints should be carefully twisted, but not opposite or touching each other, and well taped. The use of sufficient primers serves the double purpose of assuring a thorough detonation of the explosive charge and also affords a way out in case one or more should be broken or otherwise damaged during tamping.

Motor Truck Haulage Could Be Trebled.

IF THE 435,000 motor trucks in the United States were operated at 80 per cent of the efficiency possible with semi-trailers, the total tonnage hauled by these units every 12 months would be equal to 1,423,635 train loads of 55 freight cars each, or eight times as much as these trucks are now estimated to be hauling annually," declared H. C. Fruehauf, general manager of the Fruehauf Trailer Company.

"According to recent estimates the 435,000 motor trucks in this country have an average load capacity of 2½ tons each. However, careful investigation developed the fact that the average motor truck operates at about 35 per cent efficiency. That is to say that a big majority of the motor trucks are not loaded to their full capacity while being operated.

"Increased operating efficiency in motor trucks is imperative. The freight car and locomotive shortage is so great that we should make the widest and best use of our transportation facilities. Our experience, based on practical demonstrations, has been that a semi-trailer and truck will haul three times as much as the truck alone—and over the same roads and under the same conditions."

Chemical Analyses of Igneous Rocks.

THE RESULTS of more than 8,600 chemical analyses of igneous rocks are recorded in Professional Paper 99 of the United States Geological Survey, Department of the Interior, recently published.

As the last previous similar compilation, published in 1903, included only 2,881 analyses, it is evident that great progress has recently been made in this branch of geology, and this progress is shown not only in the number of analyses but in their quality and completeness. The minor constituents of igneous rocks are now determined more frequently than formerly, the chemist thus helping to enlarge the petrographer's knowledge, which is even yet deficient.

H. S. Washington, the author of this paper, after discussing the character and use of analyses, gives to each analysis a systematic rating and classifies and names the rocks analyzed according to their chemical composition by a system proposed some years ago by four well-known petrologists, Messrs. Cross, Iddings, Pirsson and himself.

THE CONTENTS of PIT AND QUARRY are very interesting to me and I believe that a publication of this kind will meet with a general demand.—H. Rettinghouse, Chief Engineer, Chicago, St. Paul, Minneapolis and Omaha Railway, St. Paul, Minn.

WISH to thank you for PIT AND QUARRY, which is appreciated and which we consider a very good trade journal for our trade, filling a long felt want.—Tuckahoe Sand & Brick Co., Philadelphia, Pa.

Phosphate Rock Industry Gaining.

THE PHOSPHATE ROCK industry, which suffered severely in 1915 and 1916 by the war in Europe, made a strong recovery in 1917. In spite of the shortage of railroad cars and fuel oil that affected the output of the eastern fields the quantity of phosphate rock marketed in 1917, according to R. W. Stone, U. S. Geological Survey, Department of the Interior, was 2,584,287 long tons, valued at $7,771,084, as compared with 1,982,385 tons, valued at $5,896,993, in 1916.

The output by States is shown below.

PHOSPHATE ROCK MARKETED IN 1917

State—	Quantity, Long tons.	Value.
Florida	2,022,599	$5,464,493
South Carolina	33,485	138,482
Tennessee, including several thousand tons from Kentucky	413,107	2,126,353
Idaho, Utah, Wyoming	15,096	41,756
	2,584,287	$7,771,084

A notable feature of the war was the increase in production in the Western States, where there are now four producers instead of only one or two, and the output was considerably greater than in any previous year. It is expected that the output from the Rocky Mountain phosphate fields will continue to grow, for the crop is of high grade and abundant, and the demand for it should increase as the country on the Pacific slope is developed.

The demand on the United States to supply food not only for herself but for her allies, in larger quantity than ever before, means intensive agriculture and the use of great quantities of fertilizers. Phosphate rock should be produced in 1918 in greater quantity than in 1917, and the output may approximate pre-war tonnage.

Canadian Gravel and Stone.

DURING 1916 the production of sand and gravel in Canada amounted to 8,156,207 tons, valued at $1,838,320, showing an increase of 1,710,490 tons, or 26.5 per cent in quantity and $213,553, or 13.1 per cent in value, as compared with the production reported for 1915. More than half of this quantity was for railway ballast.

The total value of limestone was $2,224,091, showing a slight decrease under the 1915 output. Crushed stone amounted to $1,649,219 for a production of 1,387,235 tons. The production of furnace flux was 824,110 tons, valued at $480,230, a small increase in both quantity and price over 1915.

Position of Well-Drill Bore Holes.

AS A USUAL THING well-drill holes are driven and blasted in one line, the bore holes being equi-distant from the face. All the stone is then removed before the next blast is made. Occasionally, in very hard material, better results are obtained by staggering the holes.

There is also another method of drilling and blasting known as shooting against the bank, or "buffer" shooting. By this is meant that a line of bore holes is shot down and then another line back of that is blasted before any of the debris from previous shot is removed. The first lift acts as a buffer to the second blast. This method is particularly well adapted to limestone formation in which the stone is flat and thinly laminated or disintegrated on top, and the face does not exceed 40 feet in height. It is only necessary to loosen the bottom in such a formation. "Buffer" shooting eliminates necessity of moving the shovel as often as when the clear bank method is used, or lifting and laying tracks so frequently. Care must be taken not to load too high when this method is used, as often the break-back makes it difficult to drill the next line of bore holes.

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BUCKET ELEVATORS, with buckets on chain or belt, furnished with or without steel casings.

BUCKETS—standard types in steel or malleable iron, steel buckets of special design made to your specifications.

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SHAFTING, PULLEYS, BEARINGS, FRICTION CLUTCHES.

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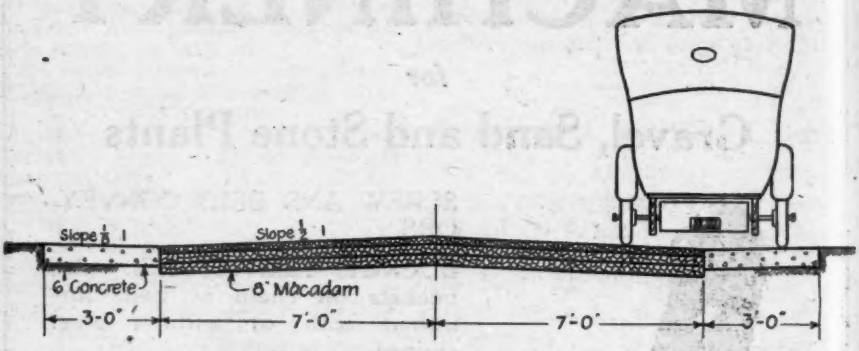
Western Ave., 17th and 18th Sts.

Concrete Shoulders for Wagon Roads

A VERY general practice in road building, adopted during the past five years, in most sections of this country, is to use an earthen shoulder on the sides of bituminous macadam. That is, a road bed of either mixed bituminous macadam or one made by the penetration method is laid, varying in width from fourteen to twenty-two feet, and then shoulders on each side from four to five feet wide are built of dirt.

This has cheapened the construction and it was thought that but little wear would come upon the shoulders, as the vehicles would stay on that portion of the road that presented a hard surface. This theory has not worked out in practice. Rains easily wash these shoulders, and horse-drawn vehicles in wet weather are driven partly on the hard surface and also on the shoulders, so the horses can walk upon the dirt to avoid slipping. Then, too, the large automobile trucks, especially the van type, must have ample room to pass other vehicles, and especially one another, so that they, too, must go out on the shoulders.

This traffic quickly wears out the shoulders, with the result that the edge of the macadam is broken up and soon begins to ravel and wear into the hard road surface towards the center. This makes expensive maintenance, and a worn edge on the bituminous macadam and a soft shoulder means a dangerous road for automobiles.



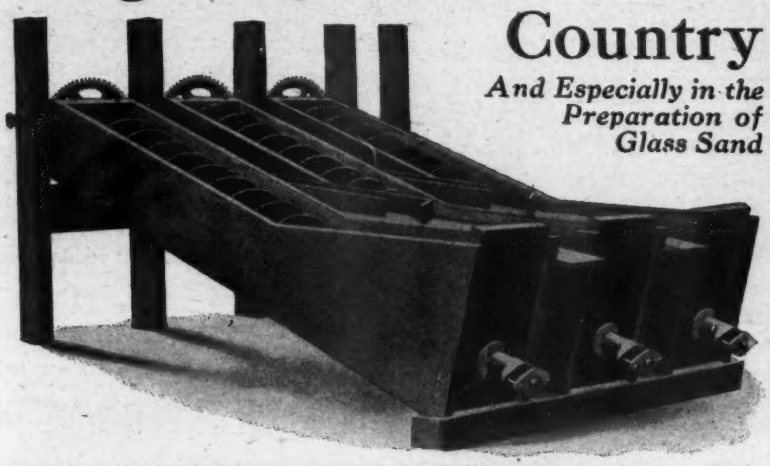
Typical Section of Macadam Road, Showing Proposed Concrete Shoulders

The roadway between the cities of Baltimore and Washington carries not only a large traffic of pleasure cars but a heavy traffic of trucks, and the condition of the shoulders has become such that it was deemed necessary to replace them with some hard road material. After considering several methods of constructing these shoulders, it was decided to use concrete.

This work is now going on. The sketch shows the old earth shoulders and the new concrete shoulders, which are made 2 feet wide and 6 inches deep. On sharp curves, the shoulder is placed on the inside of the curve only and is widened to 4 feet at the center of the curve. In building these shoulders the dirt is excavated and spread out on the sides, where there is room, otherwise it is hauled away and used to repair shoulders elsewhere. Then a form is set on the

Used in Some of the Largest Quarries in the Country

And Especially in the Preparation of Glass Sand



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Sand Washers

These are reasonably priced, well built, compact outfits, which can be easily and quickly installed. They are simple in construction and efficient in operation. Extensively used in the manufacture of glass sand which is so much needed today in the making of optical lenses for field glasses, telescopes, etc., required by the Government.

If you are not acquainted with Lewistown equipment and service, it will pay you to look into it.

We are in position to assist you solve your problem of whatever nature, if it pertains to crushing, grinding, screening, washing, drying and conveying, as we manufacture a full line of this machinery and equipment. Drop us a line stating what you desire information on.

Lewistown Fdy. & Machine Co.

LEWISTOWN, PENN.

outside of the road and the concrete is mixed and placed between the macadam and the form. This work is being done under the direction of J. N. Mackall, chief engineer of the Maryland State Road Commission, of which Frank H. Zouck is chairman.

State Aid Roads.

THE FIRST STATE AID on highway improvements probably that was ever supplied was furnished by the state of New Jersey in 1891, and that was so successful that gradually it has developed until other states have taken it up; and in July, 1916, the federal government stepped in and made an appropriation of $75,000,000 to be expended on rural post roads throughout the United States. Part of that money is available at this time. This Act authorizes the Secretary of Agriculture to co-operate with the states through their respective highway departments, in the construction of rural post roads. Of the $75,000,000 appropriated by this Act, $5,000,000 is made available for the fiscal year ending in June, 1917; $10,000,000 for 1918; $15,000,000 for 1919; $20,000,000 for 1920 and $25,000,000 for 1921. This money was pro rated by the government on the basis of population, area and mileage of rural post roads in each state.

PIT & QUARRY is the first along its line and we are pleased to receive a copy of each number, as the contents of your paper are very interesting and helpful.—The Cleveland Stone Co., Cleveland, Ohio.

Trade Literature

THE POLLARD MFG. CO., LTD. Niagara Falls, Canada. "Derricks and Hoists"; Catalog "D," 6x9 in., 26 pages, 3 colors, illustrated.

THE LINK-BELT COMPANY, CHICAGO. "The Efficient Drive for Machine Tools"; Link-Belt Silent Chain, Book No. 312, 6x9 in., 42 pages, 2 colors, highly illustrated.

CARNEGIE STEEL COMPANY, Pittsburgh, Pa. "Steel Derricks and Drilling Rigs" (5th Edition); 5x7¾ in., 100 pages, illustrated, 3 colors.

THE TITAN TRUCK COMPANY, MILWAUKEE, Wis. "The Titan Truck" (5 to 6 ton, built for contractors and heavy haulage service); 8½x11 in., 12 pages, 4 colors, illustrated.

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SASGEN DERRICK COMPANY, Chicago, Ill. "Sasgen Stiff-Legged Derricks"; 6-page folder, 2 colors, illustrated.

INGERSOLL-RAND COMPANY, Easton, Pa. "Leyner Shank and Bit Punch" (1R type); for punching out holes in bits and shanks of hollow drill steel; 6x9 in., 8 pages, illustrated. "Class FP Steam Engines," horizontal center crank type with piston valves; 1-page flyer, 8½x11 in., 2 colors, illustrated. "Little David Evaporator Tube Cleaner"; 4-page flyer, 8½x11 in., 2 colors, illustrated. "Portable Mine Car Air Compressors (Class ER-1); 4-page bulletin, form 3015-1, 6x9 in., illustrated. "Barometric Condensing Plants"; single-page flyer entitled "Spare the Coal Pile" (Form 876); 2 colors, illustrated.

ALLIS-CHALMERS MFG. CO., Milwaukee, Wis. "Modern Rock Crushing Plants" (Bulletin 1411). Illustrated with several designs of plants and machinery to go therein; 8x10½ in., 44 pages. "Portable Rock Crushing Plants" (Bulletin 1405); 8x10½ in., 12 pages, illustrated. "Allis-Chalmers Pulverator"; 3½x6¼ in., 8 pages, illustrated. "Forged Steel Balls for Ball Mills"; 8x10½ in., 8 pages, illustrated. "Gates Tube Mill." For wet pulverizing in mining work; Bulletin 1410; 8x10½ in., 24 pages, illustrated. "Gates Rock and Ore Crusher" (Style D); 8x10½ in., 20 pages, illustrated. "Allis-Chalmers Rotary Kilns" (Bulletin 1430); 8x10½ in., 12 pages, illustrated. "Ribbed Tube Mill Lining" (Bulletin 1440); 8x10½ in., 4 pages, illustrated. "Gates Breakers" (Bulletin 1441); 8x10½ in., 16 pages, illustrated. "Machinery for Cement Making" (Bulletin 1444). Ball mills and tube mills; 8x10½ in., 16 pages, illustrated. "Gates Rock and Ore Breaker." (Style K, Bulletin 1448); 8x10½ in., 24 pages, illustrated. "Sample Grinders and Style F Gyratory Breakers" (Leaflet 2036); 8x10½ in., 4 pages, illustrated. "Crushing Roll Data for the Determination of Sizes of Feed, Peripheral Speeds and Capacities" (Leaflet 2038); 8x10½ in., 4 pages, illustrated.